(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 480 653 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **91309162.5**

(51) Int. Cl.^{5} : **A61B 17/34**

(22) Date of filing : **07.10.91**

(30) Priority : **09.10.90 US 594319**

(43) Date of publication of application :
15.04.92 Bulletin 92/16

(84) Designated Contracting States :
AT BE CH DE DK ES FR GB GR IT LI LU NL SE

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(54) Surgical access sheath.

(57) A surgical trocar access sheath (10) having a laterally expandable retention mechanism (17) for percutaneous insertion through a body cavity wall. The expandable retention mechanism is positioned about the distal end of the sheath for retaining the access sheath within the body cavity. The access sheath has an inner elongated member cannula (19) and an outer elongated member tube (13) having a slick surface for ready insertion through a puncture site. The laterally expandable retention mechanism includes a plurality of strips (18) extending and formed longitudinally in the outer tube. The retention mechanism has an expanded state and a retracted state. In the expanded state, the longitudinal strips extend radially from the outer elongated member tube to engage the interior surface of the body cavity wall. The expandable retention mechanism is actuated by sliding an actuating mechanism hub (26) attached to the distal end of the outer elongated member tube against another hub (23) fixedly attached to the inner elongated member cannula. To insert or retract the access sheath through the cavity wall of a patient, the physician squeezes the actuating mechanism hub against the fixed hub to collapse the longitudinal strips against the surface of the inner elongated member cannula. Once inserted, the actuating mechanism is released to expand the retention mechanism.

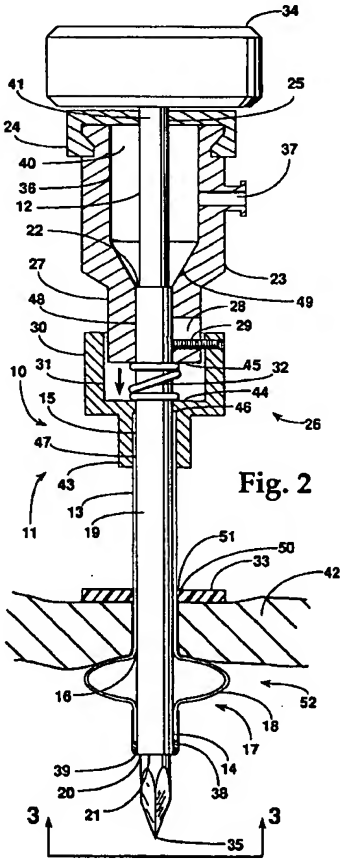

Fig. 2

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This invention relates to surgical trocar access sheaths.

During repeated insertion and removal of surgical instruments, the access sheaths can be inadvertently forced further into the cavity or pulled through the puncture site. A problem with inadvertent removal is that the sheath must be subsequently reinserted into the body cavity through the puncture site. Should a large amount of the insufflating gas escape through the puncture site, the reinsertion of the access sheath with a trocar presents the risk of perforating an organ such as a bowel which contaminates the surgical field along with requiring suturing of the perforated tissue.

Suprapubic bladder catheters and gastrostomy feeding tubes typically utilize a balloon retention cuff to prevent inadvertent removal through the abdominal wall. This introduces disadvantages.

According to the present invention there is provided surgical apparatus as defined in claim 1.

A retainer cap is also fixedly positioned at the distal end of the outer and inner elongated members to maintain the relative fixed position of the two distal ends. The retainer cap is also beveled to further ease entry of the access sheath through the puncture site.

Brief description of the drawings

FIG.1 depicts a preferred embodiment of the surgical trocar access sheath;

FIG.2 depicts a partial cross-sectional view of the surgical apparatus of FIG.1; and

FIG.3 depicts a front view of the surgical apparatus of FIG.2 along the line 3-3.

The sheath apparatus 10 is for percutaneous insertion into a body cavity such as the peritoneal cavity, and includes access sheath 11 with trocar rod 12 longitudinally extending through the sheath. The trocar rod includes a well-known three-sided pointed distal end 35 for puncturing the abdominal wall and an end cap 34 for pushing the trocar rod and tube 13 through the abdominal wall and into the peritoneal cavity. Trocar rod 12 is, for example, 300 series stainless steel approximately 14.45cms (5.6875") in length and 0.495cms (0.195") in diameter. Proximal end 41 of the rod includes a plurality of 8-32 threads for attaching end cap 34 thereto. The distal end of the rod is ground to form three-sided pointed distal end 35. End cap 34 is a cylindrical disk of a high durometer copolymer material approximately 1.59cms (0.625") in height and having a diameter of 4.06cms (1.6"). The disk is tapped with 8-32 threads to a depth of 1cm (0.4").

Access sheath 11 includes outer elongated member tube 13 and a rigid inner elongated member cannula 19 attached together about their distal ends with retainer cap 38. Retainer cap 38 is a stainless steel sleeve approximately 0.66cms (0.26") in length with an outer diameter of 0.683cms (0.269"). The retainer cap is compression-fitted in a well-known manner onto the distal end of the inner and outer elongated members.

Positioned about the distal end of the outer elongated member tube is laterally expandable retention mechanism 17 which includes a plurality of strips 18 extending and formed longitudinally in the tube. Retention mechanism 17 has an expanded state and a retracted state. When the surgeon applies pressure to the cap 34, the retention mechanism is in the retracted state with longitudinal strips 18 collapsed against inner elongated member cannula 19. With the retention mechanism in the retracted state, the trocar and access sheath are in a position ready for insertion through the abdominal wall and into the body cavity. After the distal end of the access sheath is inserted into the body cavity, the surgeon releases the pressure on the cap 34, and the retention mechanism assumes the expanded state with longitudinal strips 18 expanding radially outward for retaining the access sheath within the cavity. Thus the mechanism 17 is in the expanded condition when the apparatus is in the relaxed condition and is in the retracted condition when the surgeon exerts force on the apparatus. Once the apparatus is in the expanded condition, the trocar is then removed from longitudinally extending passageway 20 of the access sheath.

Surgical apparatus 10 also includes a retention plate or disk 33 having an aperture 51 therethrough for adjustably positioning the disk along the outer elongated member tube. The retention disk, which is a commercially available 16 French disk comprised of well-known silicone material, is slideably moveable along the outer tube to the outer surface of the abdominal wall after insertion of the apparatus into the body cavity to prevent inadvertent extension of the access sheath into the cavity. The retention disk and retention mechanism cooperate together to fixedly position the access sheath with respect to the abdominal wall. Upon completion of the surgical procedure, force is again applied to the end cap 34 and the retention mechanism is collapsed to the retracted state for removal of the access sheath from the body cavity.

Depicted in FIG.2 is a partial cross-sectional view of surgical trocar access sheath apparatus 10 inserted through abdominal wall 42 and into body cavity 52 via puncture site 50. As shown, retention mechanism 17 is in the expanded state with longitudinal strips 18 extending radially outward to engage the interior surface of the abdominal wall. Retention disk 33 has been slid along outer elongated member tube 13 and engages the outer surface of the abdominal wall. As a result, the distal end of the access sheath is fixedly positioned relative to the abdominal wall.

Depicted in FIG.3 is an end view of retention mechanism 17 along the line 3-3 of FIG.2. Individual strips 18 extend radially outward from the outer elon-

gated member tube with retainer cap 38 and distal beveled edge 39 showing. Trocar 12 with three-sided pointed distal end 35 is also shown extending from the longitudinal passageway of the inner elongated member cannula.

As depicted in FIGs.1 and 2, access sheath 11 includes an outer elongated member tube 13 having distal end 14, proximal end 15, and passageway 16 extending longitudinally therethrough. Laterally expandable retention mechanism 17 is positioned adjacent to distal end 14 of the outer elongated member tube. The outer elongated member tube is comprised of a commercially available polytetrafluoroethylene polymer material having a slick surface for ready insertion of the tube through the puncture site. For example, outer elongated member tube is a 8.89cms (3.5") length of commercially available thick-wall 18 French polytetrafluoroethylene material tube. Longitudinal strips 18, approximately 0.978cms (0.385") in length, are formed about the distal end of the outer elongated member tube by cutting 8 slits in the outer tube approximately 45 degrees apart.

Positioned within passageway 16 of the outer elongated member tube is inner elongated member cannula 19 having distal end 21 attached to outer tube 13 at or adjacent to the distal end 14 with stainless steel retainer cap 38, proximal end 22, and passageway 20 extending longitudinally between the distal and proximal ends thereof. The inner elongated member is a commercially available stainless steel cannula having, for example, a length of 11.646cms (4.585") with an outer diameter of 0.584cms (0.23") and an inner diameter of 0.51cms (0.201").

The access sheath also includes a member such as a disk or proximal hub 23 attached or fixed about or adjacent to the proximal end of the inner elongated member cannula. Also included is another member such as actuating mechanism 26 positioned distally in relation to proximal hub 23 and attached or fixed about or adjacent to the proximal end of the outer elongated member tube. A spring 32 exerts an outward force on members 23 and 26 thereby forcing them apart and causing relative motion of tubes 13 and 19 to actuate the retention mechanism 17 laterally and longitudinal strips 18 radially to the expanded state. Proximal hub 23 is comprised of a commercially available polycarbonate polymer material moulded to, for example, a length of approximately 3.645cms (1.435") and an outside diameter of 2.235cms (0.88"). The proximal hub includes cylindrical chamber 36 approximately 0.935cms (0.368") in diameter with a beveled surface portion 49 narrowing to a 0.589cms (0.232") diameter and longitudinally extending passageway 48. Proximal end 22 of the inner elongated member cannula is secured in passageway 48 in a well-known manner. Proximal end 40 of the hub and chamber includes a flanged portion for attaching flexible seal 24 thereto. The flexible seal has an aperture for extending the trocar therethrough and into chamber 36. Th seal is comprised of, for example, silicone material and forms a gas-tight seal about the trocar when positioned therethrough. Extending laterally from the hub chamber is access port 37 having a well-known female Luer-lock connector for attaching an insufflation gas line thereto. The proximal end of the hub narrows to form cylindrical neck 27 which is approximately 0.6cms (0.24") in length, is slideable within the chamber of hub 30, and includes passageway 48 for receiving and securing proximal end 22 of the inner elongated member cannula. Slot 28, approximately 0.394cms (0.155") in length, extends longitudinally in the neck for receiving projection 29 such as a 4-40 x 0.635cms (0.25") set-screw for limiting the travel of actuating mechanism 26 with respect to proximal hub neck 27.

Actuating mechanism 26 includes distal hub 30 attached about or near the proximal end 15 of outer elongated member tube 13 and expansion spring 32 positioned about or near the proximal end 22 of inner elongated member cannula 19 within chamber 31 of the distal hub. The distal hub is also comprised of a commercially available polycarbonate polymer material moulded with an outside diameter of, for example, 2.2cms (0.87") with chamber 31 extending longitudinally therein for approximately 1.69cms (0.665") and having a diameter of 1.194cms (0.47"). The chamber is open ended at the proximal end of the hub and has end wall 44 at the distal end of the hub. Spring 32 positioned about the cannula engages distal end 45 of neck 27 of the proximal hub and distal end wall 44 to push the two hubs apart and actuate retention mechanism 17 to the expanded or the at-rest state. Projection 29, such as a well-known set-screw, extends radially into chamber 31 and longitudinal slot 28 of neck 27 to limit the longitudinal travel of the distal hub with respect to the proximal hub. The distal end of actuating mechanism hub 30 reduces to cylindrical neck 43 having an outside diameter of approximately 0.965cms (0.38") and a length of 0.99cms (0.39"). Neck 43 has longitudinal passageway 47 therein for receiving and attaching to proximal end 15 of the outer elongated member tube using, for example, commercially available medical grade adhesive. Shoulder 46 at the proximal end of the neck passageway limits the insertion of the outer elongated member tube within the passageway. Inner elongated member cannula slideably passes through an aperture in shoulder 46 of distal end chamber wall 44 and into the passageway of the outer elongated member tube.

In summary, actuating mechanism 26 of the access sheath maintains retention mechanism 17 in the expanded (at-rest) state with, for example, longitudinal strips 18 laterally expanded to retain the distal end of the sheath against the interior surface of the patient's abdominal wall. To insert or retract the

access sheath through the abdominal wall of the patient, the physician grasps or pulls the actuating mechanism and squeezes moveable distal hub 30 of the actuating mechanism towards the fixed proximal hub 23 to compress the spring 32 and thus collapse longitudinal strips 18 against the surface of the inner elongated member cannula.

The retention mechanism may alternatively be comprised of other radially expandable devices such as wires and other longitudinally flexible means for radially exoanding and engaging the interior surface of the abdominal wall. It is also contemplated that the actuating mechanism may alternatively be comprised of other engaging mechanisms for longitudinally sliding the inner and outer elongated members with respect to each other. Helical corkscrew arrangements for the actuating mechanisms are also contemplated.

Claims

1. Surgical access apparatus (10) comprising a first elongated member (13) with a retention arrangement (17) adjacent to the distal end thereof, the arrangement being expandable after the member has been used to penetrate a cavity wall of a patient, in order to retain the distal end of the member within the patient, a second elongated member (19) extending through a passageway (16) of the first member and connected to the first member adjacent to the distal ends of both members, and control means (23,26,32) for providing relative movement of the two members to cause the retention arrangement to expand or contract, characterised in that the control means comprises a first control member (30) fixed adjacent to the proximal end of the first elongated member, a second control member (23) fixed adjacent to the proximal end of the second elongated member, and spring means (32) for causing relative movement of the first and second control members.

2. Apparatus according to claim 1, characterised in that the first elongated member comprises an expandable section (18) forming part of the retention arrangement (17), said expandable section being formed by slits (18) in the first elongated member, the slits being located on the proximal side of the connection of the first and second elongated members.

3. Apparatus according to claim 1 or 2, characterised in that the spring means is positioned between the first and second control members.

4. Apparatus according to claim 3, characterised in that the spring means is a compression spring (32) located between the first and second control members tending to urge them apart,and to cause the said section (18) to be normally in an expanded condition.

5. Apparatus according to claim 4, characterised in that the second elongated member is longer than the first elongated member, in that the first control member is in the form of a hub (30) distal to the second control member, and in that the latter is in the form of a second hub (23) mounted to be reciprocateable relative to the first mentioned hub, with the spring tending to urge the hubs apart, and thus expand the said section.

6. Apparatus according to claim 5, characterised in that part (27) of the second hub is reciprocateably mounted within a passageway (31) of the first hub, with the spring mounted within the passageway and exerting a force on the two hubs, whereby a compressive force exerted by a surgeon on at least one of the two hubs causes the said section to be contracted to permit penetration of the distal ends of the two elongated members within a patient, and whereby removal of the said compressive force permits expansion of the said section in order to retain within the patient the penetrated part of the apparatus.

7. Apparatus according to claim 6, further characterised by a retention disk (33) moveably mounted along the outer elongated member and serving to be pressed against the outside of the patient at the place of said penetration, to clamp the said part of the apparatus in position.

8. Apparatus according to claim 5,6 or 7, characterised in that the second hub is provided with a side port in communication with the interior of the elongated members, and/or a seal (24) positioned at the proximal end of the second hub.

9. Apparatus according to claim 5,6,7 or 8, characterised in that a slot (28) and rod (29) are provided in the arrangement of the hubs to prevent relative rotational movement of the hubs and to limit relative axial movement thereof.

10. Apparatus according to any one preceding claim, characterised in that the inner rod is capable of receiving a rod with an end designed to puncture a cavity wall of a patient.

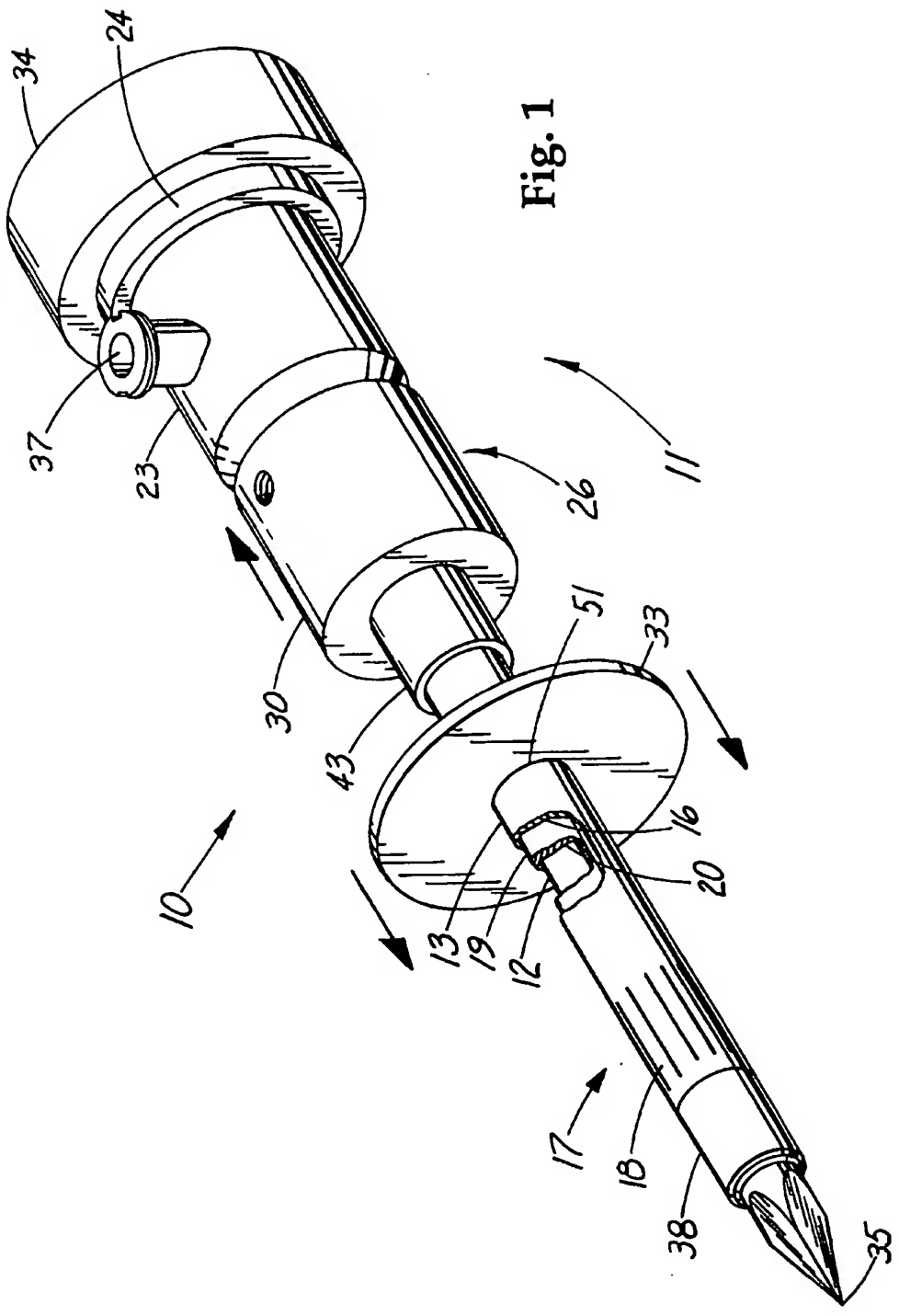

Fig. 1

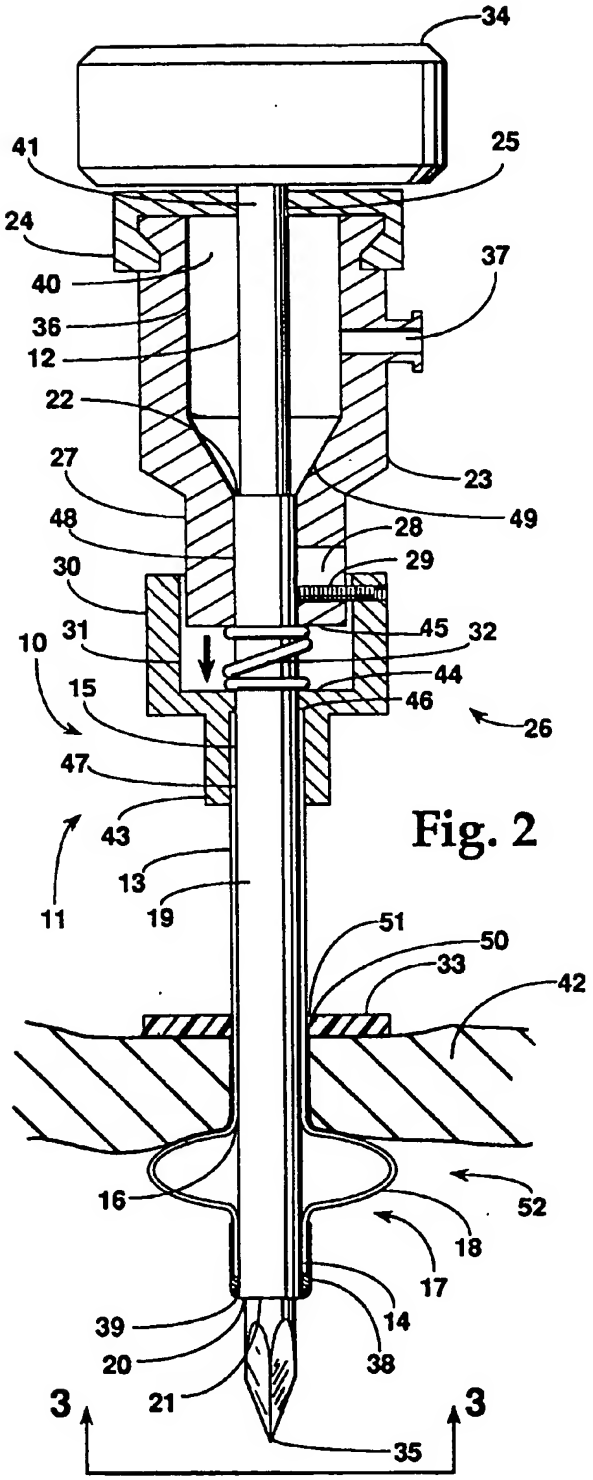
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Fig. 2

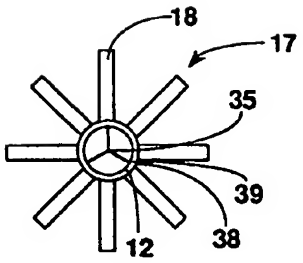
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Fig. 3

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EUROPEAN SEARCH REPORT

Application Number

EP 91 30 9162

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-4 608 965 (ANSPACH, JR. ET AL.) * column 1, line 65 - column 2, line 29; figures 1-6 *	1-10	A61B17/34
Y	US-A-3 946 741 (ADAIR) * column 1, line 1 - line 66 * * column 3, line 14 - line 27; figures 1,1A,3 *	1-10	
A	US-A-3 692 029 (ADAIR) * column 2, line 35 - column 3, line 7; figures 1,2 *	1,4	
A	US-A-3 241 554 (COANDA) * column 3, line 46 - line 71; figures 2,7 *	7	
A	US-A-4 043 338 (HOMM ET AL.) * column 2, line 1 - line 5; figure 1 *	9	
X,P	EP-A-0 432 363 (DEXIDE) * column 3, line 50 - column 5, line 32; figures 1,2 *	1-10	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5) A61B A61M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 JANUARY 1992	MOERS R.

CATEGORY OF CITED DOCUMENTS

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